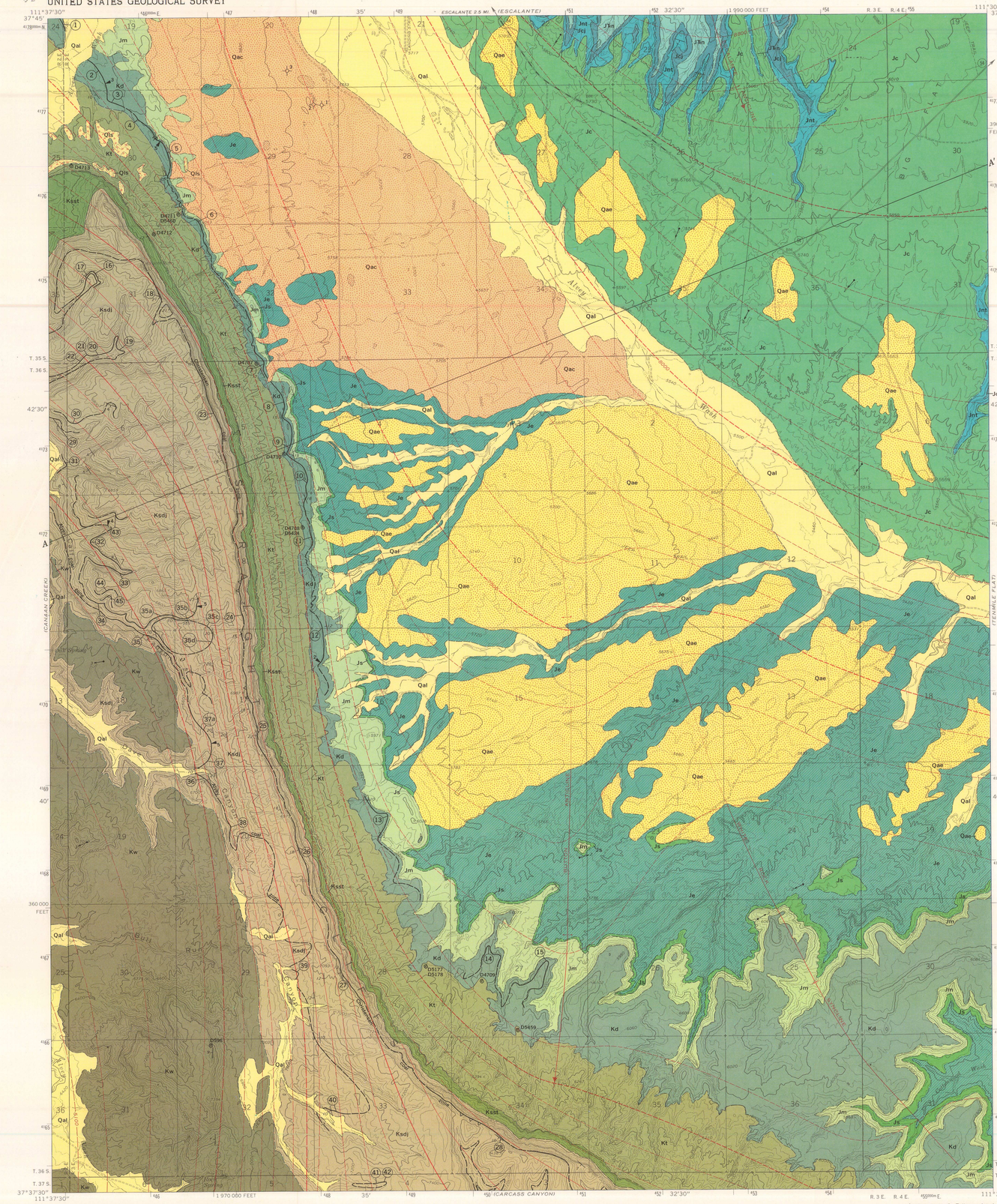
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

COAL INVESTIGATIONS
MAP C-59 (SHEET 1 OF 2)



Base from U.S. Geological Survey, 1964
10,000-foot grid based on Utah coordinate system, south zone
1000-meter Universal Transverse Mercator grid, zone 12

SCALE 1:24 000
1 MILE
1 KILOMETER
CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1973

Geology by H. D. Zeller assisted by J. W. Mercer, 1964

EXPLANATION

QUATERNARY
- Holocene
  - Qls — Landslide deposits
  - Qal — Alluvium
  - Qac — Alluvium and colluvium
  - Qae — Alluvium and eolian deposits

CRETACEOUS
- Upper Cretaceous
  - Kw — Wahweap Formation
  - Ksdj / Ksst — Straight Cliffs Formation
    - Ksdj, *Drip Tank and John Henry Members*
    - Ksst, *Smoky Hollow and Tibbet Canyon Members*
  - Kt — Tropic Shale
- Lower(?) Cretaceous
  - Kd — Dakota Formation

JURASSIC
- Upper Jurassic
  - Jm — Morrison Formation
  - Js — Summerville(?) Formation
  - Je — Entrada Sandstone
  - Jc — Carmel Formation
- Middle and Upper(?) Jurassic
  - Jnt — Thousand Pockets Tongue of Navajo Sandstone
- Middle Jurassic
  - Jcj — Judd Hollow Tongue of Carmel Formation

TRIASSIC(?) AND JURASSIC
- JTrn — Navajo Sandstone

22 — Coal bed
Dashed where approximately located; queried where doubtful. Thickness of coal, in feet, measured at triangle. Number in circle refers to measured coal section, sheet 2

Clinker and ash of burned coal bed; approximately located

Contact
Dashed where approximately located

Anticline, approximately located
Showing crestline and direction of plunge. Dotted where concealed

Syncline, approximately located
Showing troughline. Dotted where concealed

12 — Strike and dip of beds

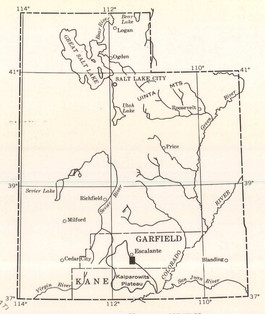
Component of dip
Dot marks point of observation

8000 — Structure contours
Drawn on top of Ksst *(Smoky Hollow and Tibbet Canyon Members of the Straight Cliffs Formation). Dashed where control less accurate; short dashed where projected over land surface*

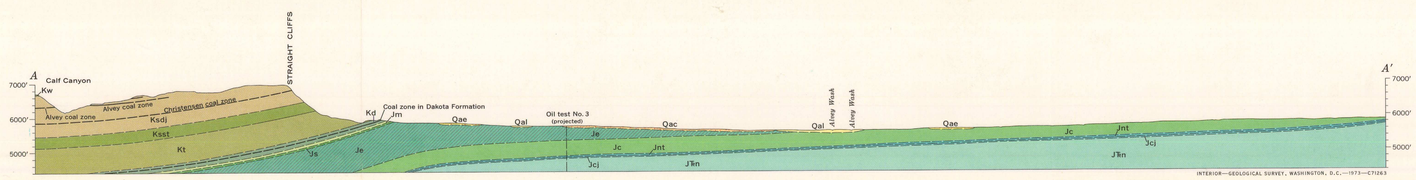
2 — Dry hole
Number refers to table 2

Abandoned coal mine

D596 — Fossil locality
U.S. Geological Survey collection number (Denver catalogue)



INDEX MAP SHOWING LOCATION OF DAVE CANYON QUADRANGLE. (C-59) GARFIELD COUNTY, UTAH



ECONOMIC GEOLOGY

The quadrangle was mapped as part of the U.S. Geological Survey program of classifying and evaluating mineral lands in the public domain. Resources of economic interest are coal, oil and gas, and titaniferous sandstone.

COAL

A summary of data pertaining to the coal deposits of the entire Kaiparowits coal field is given by Doelling (1970).

Coal beds in the Dave Canyon quadrangle occur in the Dakota and Straight Cliffs Formations of Cretaceous age, which crop out along the Straight Cliffs escarpment in the western part of the map area. Coal exposures in the quadrangle are poor because bedrock is generally concealed by slope wash and blocks of sandstone and talus. The main coal zones in this quadrangle and in adjacent areas are in the John Henry Member of the Straight Cliffs. The coal in the Straight Cliffs Formation is of better quality, occurs in thicker beds, and contains less carbonaceous shale than that in the Dakota.

The uppermost coal zone in the Straight Cliffs Formation, the Alvey, is about 1,200–1,300 feet above the base of the formation, and the lowermost coal zone, the Christensen, is about 760–860 feet above the base. Individual coal beds are in general lenticular, grade laterally into carbonaceous shale, and in a few places interfinger with sandstone that was deposited along a beach. Marine oyster beds occur below and above coal beds, indicating fluctuations of the shoreline. The strand line during deposition of the Alvey coal zone trended about N. 20° W., and field observations indicate that both the Alvey and the Christensen coal zones are more persistent in a northwesterly direction. The coal was deposited in a lagoonal-type environment, and coal beds are less continuous perpendicular to the strand line.

Coal beds 1 or more feet thick are indicated on the geologic map and are shown in the coal sections (sheet 2) where observed; however, because the coal is lenticular, only the thicker coal beds were extended any distance from an outcrop. In general, the symbol or line showing a coal bed on the geologic map represents a single bed; however, on steep cliff faces it may represent an interval of as many as four coal beds, as shown in coal sections 27 and 28.

In the Dakota Formation the better coal occurs in coal sections 5–8, where the beds, although poor in quality, attain a thickness of 5 feet. In the Straight Cliffs Formation, the Christensen coal zone has much coal in thick beds along the Straight Cliffs escarpment; the thickest individual bed is 15 feet thick (coal section 25). In the Alvey coal zone the thickest coal, in coal sections 32–35, is in beds 6–10 feet thick.

Quality.—The Dakota coal beds are highly weathered and poorly exposed along the outcrop, and in the absence of any open mines or prospects, no samples were obtained for analysis. In general, the Dakota coals are thin and lenticular, generally 2 or 3 feet thick, and only at coal sections 5–8 do they attain a thickness of 5 feet.

Five miles north of the quadrangle, Robison (1963, p. 17) collected an outcrop sample of Dakota coal that has a heating value of 11,081 British thermal units; however, this coal has a high content of ash (16.8 percent) and sulfur (3.1 percent) and a low fixed carbon content (32.4 percent).

Coal in the Straight Cliffs Formation is of much better quality. An analysis of the coal in the Christensen zone at the Don Shurtz mine 1½ miles west of the quadrangle (Gregory and Moore, 1931, p. 153) on an air-dried basis shows 12.20 percent moisture, 39.35 percent volatile matter, 44.20 percent fixed carbon, 4.25 percent ash, and 0.82 percent sulfur and a heat value of 11,108 British thermal units.

The Alvey coal zone is best represented by the coal in the Alvey mine, half a mile west of the quadrangle. This coal on an as-received basis contains 12 percent moisture, 38.1 percent volatile matter, 42.8 percent fixed carbon, 7.1 percent ash, and 0.6 percent sulfur and has a heat value of 10,730 British thermal units. More detailed information on the quality of the coal in the area is given by Robison (1963, 1964) and Grose, Hileman, and Ward (1967).

Mines and prospects.—The only coal mine (abandoned) is near the northwest corner of the quadrangle in the Dakota Formation. The early settlers of Escalante, Utah, first mined coal here because it was easily accessible by wagon from the town 2 miles away. The mine is completely caved in, but parts of a wooden coal car and a track are still on the site.

Resources.—Coal reserves were not calculated for individual beds within a coal zone because of limited exposures and the lenticularity of the beds. Total resources were estimated by adding the average thicknesses of coal in each zone in beds more than 4 feet thick and multiplying by the average weight of 1,770 tons per acre-foot for subbituminous coal; beds below 2,000 feet of overburden were not considered. The Dave Canyon quadrangle contains about 200 million tons of total coal resources.

OIL AND GAS

Three oil tests were made near the northwest corner of the quadrangle (table 2). Oil shows in the Kaibab Limestone and the Toroweap Formation in well 1 A. J. Button and free oil swabbed from the Toroweap in well "A" 1 Button indicate that the Toroweap is a significant objective for oil exploration (Kunkel, 1965).

TITANIFEROUS SANDSTONE

In secs. 7 and 17, T. 36 S., R. 3 E., black sandstone deposits occur in the upper part of the John Henry Member of the Straight Cliffs Formation. A deposit in sec. 17 described by Dow and Batty (1961, p. 11) is 12 feet thick. The upper 6 feet, which is dark purplish gray and very hard, contains 13.4 percent TiO_2, 6.5 percent ZrO_2, 11.7 percent Fe, and 0.09 percent equivalent ThO_2. The lower 6 feet, which is dark buff and softer, contains 24.1 percent TiO_2, 18.1 percent ZrO_2, 17.8 percent Fe, and 0.15 percent equivalent ThO_2. Mineral claims have been made on these deposits, but no commercial mining has been done.

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Gregory, H. E., and Moore, R. C., 1931, The Kaiparowits region, a geographic and geologic reconnaissance of parts of Utah and Arizona: U.S. Geol. Survey Prof. Paper 164, 161 p.

Grose, L. T., Hileman, D. H., and Ward, A. E., 1967, Coal resources of southwestern Utah: U.S. Bur. Mines Inf. Circ. 8326, 78 p.

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Kunkel, R. P., 1965, History of exploration for oil and natural gas in the Kaiparowits region, Utah *in* Geology and resources of south-central Utah—Resources for power: Utah Geol. Soc. Guidebook to Geology of Utah, no. 19, p. 93–111.

Munger, R. D., Greene, John, Peace, F. S., and Liming, J. A., 1965, Pre-Pennsylvanian stratigraphy of the Kaiparowits region, south-central Utah and north-central Arizona *in* Geology and resources of south-central Utah—Resources for power: Utah Geol. Soc. Guidebook to Geology of Utah, no. 19, p. 13–29.

Robison, R. A., 1963, A reconnaissance survey of the coal resources of southwestern Utah: Utah Geol. and Mineralog. Survey Spec. Studies 3, 40 p.

———1964, Progress report on the coal resources of southern Utah—1963: Utah Geol. and Mineralog. Survey Spec. Studies 7, 28 p.

Wengerd, S. A., and Strickland, J. W., 1954, Pennsylvanian stratigraphy of Paradox salt basin, Four Corners region, Colorado and Utah: Am. Assoc. Petroleum Geologists Bull., v. 38, no. 10, p. 2157–2199.

TABLE 1.—*FOSSIL COLLECTIONS*

[Cephalopod and pelecypod identification and zone assignment by W. A. Cobban, gastropod identification by N. F. Sohl, and vertebrate identification by G. E. Lewis, all of the U.S. Geological Survey. Locations of fossil collections are shown on the geologic map, and the stratigraphic positions are given in the generalized columnar section of rocks]

USGS locality No.	Collector(s)	Fossils		
D596	H. D. Zeller and J. W. Mercer.	Fragmentary specimens: "One incomplete opisthocoelous vertebra, with centrum and the proximal part of the neural arch, is seemingly an anterior dorsal or posterior cervical of a small ornithischian dinosaur of the Suborder Ornithopoda, Family Hadrosauridae. I would compare it to *Claosaurus* (of the Niobrara) were it not for the inadequate published descriptions of this genus. Two fragments of teeth represent a crocodilian and a dinosaur of the Suborder Theropoda" (G. E. Lewis, written commun., Dec. 28, 1964).		
D4707	——do——	*Exogyra olisiponensis* Sharpe		
D4708	H. D. Zeller, W. A. Cobban, G. H. Horn, and E. V. Stephens.	*Trochacythus?* sp. (a solitary coral) *Gryphaea newberryi* Stanton *Psilomya meeki* (White) *Metoicoceras whitei* Hyatt *Plicatula hydrotheca* White *Veniella* n. sp. *Corbula kanabensis* Stanton	*Kanabiceras septemseriatum* (Cragin) *Mesostoma?* sp. *Euspira* n. sp. (= *Lunatia concinna* Stanton non Hall and Meek) *Inoceramus pictus* Sowerby *Exogyra lewis* Stephenson *Sciponoceras gracile* (Shumard)	*Pecten (Camptonectes)* sp. *Lima utahensis* Stanton *Lucina* sp. *Allocrioceras annulatum* (Shumard) *Turrilella whitei* Stanton *Periscoptera prolabiata* (White) *Mesorhytis? walcotti* White
D4709	H. D. Zeller and J. W. Mercer.	*Camptonectes platessa* White *Corbula kanabensis* Stanton *Allocrioceras annulatum* (Shumard) *Turrilella whitei* Stanton *Mesostoma?* sp.	*Euspira* n. sp. (= *Lunatia concinna* Stanton non Hall and Meek) *Exogyra lewis* Stephenson *Psilomya meeki* White *Sciponoceras gracile* (Shumard)	*Metoicoceras whitei* Hyatt *Cerithiopsis* n. sp. *Periscoptera prolabiata* (White)
D4710	——do——	*Inoceramus pictus* Sowerby *Gryphaea newberryi* Stanton *Camptonectes platessa* White *Psilomya meeki* (White) *Lucina* sp. *Corbula kanabensis* Stanton *Allocrioceras annulatum* (Shumard) *Metoicoceras whitei* Hyatt	*Cerithiopsis* n. sp. *Euspira?* n. sp. (= *Lunatia concinna* Stanton non Hall and Meek) *Mesorhytis? walcotti* Stanton *Ringicula (Ringicula) codellana* Kauffman and Pope *Pteria* sp. *Exogyra lewis* Stephenson	*Lima utahensis* Stanton *Psilomya concentrica* (Stanton) *Solemya? obscura* Stanton *Sciponoceras gracile* (Shumard) *Kanabiceras septemseriatum* (Cragin) *Turrilella whitei* Stanton *Periscoptera prolabiata* (White) *Palaxmete?* sp.
D4711	H. D. Zeller	*Metoicoceras whitei* Hyatt		
D4712	——do——	*Collignoniceras woollgari* (Mantell)		
D4713	W. M. Christensen and H. D. Zeller.	*Ostrea* sp.	*Collignoniceras woollgari* (Mantell)	
D5177	H. D. Zeller	*Exogyra olisiponensis* Sharpe		
D5178	H. D. Zeller and F. J. Alvey.	*Breviarca* sp. *Psilomya meeki* (White) *Dentalium* sp. *Allocrioceras annulatum* (Shumard) *Kanabiceras septemseriatum* (Cragin) *Exogyra* sp.	*Veniella* n. sp. *Periscoptera prolabiata* (White) *Ostrea* sp. *Turrilella whitei* Stanton *Sciponoceras gracile* (Shumard) *Scaphites* sp.	*Inoceramus pictus* Sowerby *Lima utahensis* Stanton *Euspira* n. sp. *Metoicoceras whitei* Hyatt
D5424	W. A. Cobban and G. H. Horn.	*Protarca?* sp. *Plicatula hydrotheca* White? *Exogyra* sp.	*Veniella* sp. "Probably same stratigraphic level as that from which Edson Alvey collected the ammonite * * * *Pseudocalycoceras* n. sp." (W. A. Cobban, written commun., Nov. 15, 1966).	
D5459	H. D. Zeller	*Placenticeras stantoni* Hyatt		
D5460	Edson Alvey	*Calycoceras* sp.		

TABLE 2.—*LIST OF WELLS DRILLED FOR OIL*

Number on geologic map	Company and well	Location in T. 35 S., R. 3 E	Drilling ceased or well abandoned	Elevation of hole (ft)	Total depth (ft)	Lowest formation reached	Well status and remarks
1	Tenneco Oil Co., well 1 A. J. Button.	C NE¼NE¼ sec. 29.	June 1963	5,779	5,483	Cedar Mesa Sandstone Member of Cutler Formation.	Abandoned oil test. Oil shows in Kaibab Limestone and Toroweap Formation.
2	Tenneco Oil Co., well 2 A. J. Button.	W½NE¼NE¼ sec. 29.	October 1963	5,797	7,223	Redwall Limestone	Abandoned oil test.
3	Tenneco Oil Co., well "A" 1 Button.	C SW¼SE¼ sec. 20.	February 1965	5,796	5,093	Toroweap (?) Formation.	Abandoned oil test. Some noncommercial oil swabbed from Toroweap Formation at 4,907–4,983 ft.

GEOLOGIC MAP AND COAL RESOURCES OF THE DAVE CANYON QUADRANGLE, GARFIELD COUNTY, UTAH

By
Howard D. Zeller

1973

For sale by U.S. Geological Survey, price $1.00 per set